

High-Conductance Thermal Interfaces Based on Carbon Nanotubes, Phase II

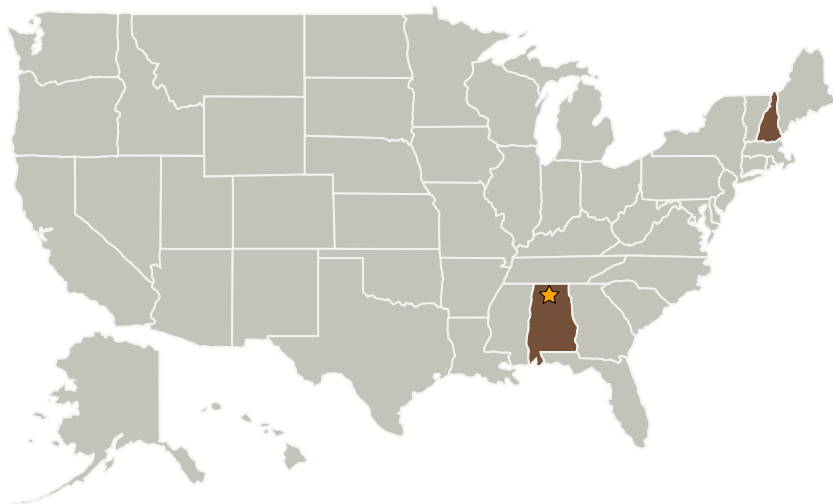
Completed Technology Project (2006 - 2008)



Project Introduction

The new devices and missions to achieve the aims of the NASA's Science Mission Directorate (SMD) are creating increasingly demanding thermal environments and applications. A key element that drives the design of thermal management systems in these demanding applications is the thermal interface material (TIM) between mating surfaces. Our innovation is a novel, vacuum-compatible, durable, heat-conduction interface that employs carbon nanotube (CNT) arrays directly anchored on the mating metal surfaces via microwave plasma-enhanced, chemical vapor deposition (PECVD). By directly anchoring the CNTs to the metal surface, the joint conductance is substantially increased over current TIMs due to the elimination of thermal contact resistance at the metal surface-TIM interface. During the Phase I project, we demonstrated thermal resistance values of approximately 35 mm² K/W at a contact pressure of 0.7 MPa in testing at Creare for a direct-deposited, CNT-based, thermal interface on copper substrates. Using this approach, our team partner has demonstrated thermal resistance values as low as 8 mm² K/W, demonstrating the remarkable potential of this innovation. The use of our innovative CNT-based TIMs will enable increased reliability, decreased size, and increased performance of spaceborne thermal management systems for the SMD.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
Alabama	New Hampshire

Project Transitions

**December 2006:** Project Start**November 2008:** Closed out

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.3 Heat Rejection and Storage